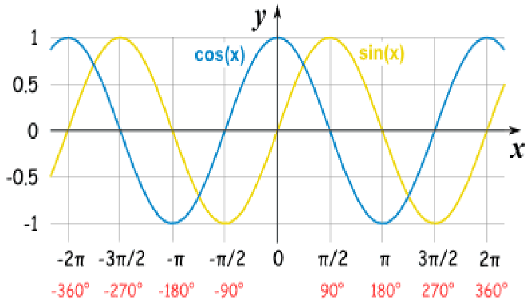
Week 4/5
Term 1
2024

HAWKER COLLEGE

Engage | Inspire | Achieve

SMM3

Goals



This fortnight we are going to:

- Review and use the power, chain, product, and quotient rule for differentiation
- Find the derivatives of exponential functions of the forms: $y = e^x$ and $y = e^{f(x)}$
- Find the derivatives of logarithmic functions of the forms: $y = \ln(x)$ and $y = \ln[f(x)]$
- Find the derivatives of trigonometric functions: $\sin(x)$, $\cos(x)$ and $\tan(x)$

Theoretical Components

Make notes on the following chapters:

Maths Quest 12 Mathematical Methods

- 7C - The derivative of x^n
- 7D - The chain rule
- 7E - The derivative of e^x
- 7F - The derivative of $\ln(x)$
- 7G - The derivatives of $\sin(x)$, $\cos(x)$ and $\tan(x)$
- 7H - The product rule
- 7I - The quotient rule
- 7J – Mixed problems

Chain Rule proof:

- https://www.khanacademy.org/math/ap-calculus-ab/ab-differentiation-2-new/ab-diff-2-optional/v/chain-rule-proof

Implicit Differentiation:

- https://www.khanacademy.org/math/differential-calculus/dc-chain/dc-implicit-diff/v/implicit-differentiation-1

Practical Components

Do the following questions:
Organise your solutions neatly in your exercise book.

Chapter 7 of Maths Quest 12 Mathematical Methods (pdf – Google Classroom)

- 7C: as many until you feel confident
- 7D: 9-18
- 7E: 5 (3rd column),6-9
- 7F: 7-13
- 7G: 1-3 (as many until you feel confident), 4, 7-10 (as many until you feel confident), 13
- 7H: 4 (1st column)
- 7I: 4 (1st column), 6-10
- 7J: 3 (1st column)

Portfolio Task

See next page

Start your assignment

Other

Come and see me if you need help using your CAS.

Fun fact: A function that is differentiable must also be continuous. But is the converse true? The answer is no: in 1872, the German mathematician Karl Weierstrass came up with a function that is continuous everywhere, but differentiable *nowhere*.

Week 4 and 5 Investigation

Implicit Differentiation: We have only been differentiation curves whose equations has the form $y = f(x)$, where $f(x)$ is a function. But solving an equation for y can sometimes be difficult or impossible, and sometimes the curve may not even be a function. The purpose of this rather more difficult section is to extend differentiation to curves like the circle $x^2 + y^2 = 25$, which may not be functions, yet are still defined by an algebraic equation in x and y.

Differentiating Expressions in x and y: The first step is using the chain, product and quotient rules to differentiate expression in x and y where x and y are related. In this situation, neither x nor y is constant, and in particular y must be regarded as a function of x.

Example: Differentiate x^2y with respect to x.

$$\frac{d}{dx}(x^2y) = y\frac{d}{dx}(x^2) + x^2\frac{d}{dx}(y)$$
$$\frac{d}{dx}(x^2y) = 2xy + x^2\frac{dy}{dx}$$

Extra support: https://www.youtube.com/watch?v=M0SMSWM2oZA
Question:

Differentiate $x^3 + xy^2 = x^2y + y^3$ with respect to x.